

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 4-33285A/USN	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/EP2004/007952	International filing date (day/month/year) 16.07.2004	Priority date (day/month/year) 17.07.2003	
International Patent Classification (IPC) or national classification and IPC C07D209/24, C07D213/20			
Applicant NOVARTIS AKTIENGESELLSCHAFT			

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (<i>sent to the applicant and to the International Bureau</i>) a total of 2 sheets, as follows:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. <p>b. <input type="checkbox"/> (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>
<p>4. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Box No. I Basis of the opinion <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application

Date of submission of the demand 28.04.2005	Date of completion of this report 27.09.2005
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International application No.
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Box No. I Basis of the report

- With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3 and 23.1(b))
 - publication of the international application (under Rule 12.4)
 - international preliminary examination (under Rules 55.2 and/or 55.3)
- With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-10 as originally filed

Claims, Numbers

1-12 as amended (together with any statement) under Art. 19 PCT

a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to sequence listing (*specify*):

4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-12
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-12
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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V. Reasoned statement

Reference is made to the following documents:

D1: WO02/072260

D2: FR-A-2 829 763

D3: Zulfiqar & Kitazume, Green Chemistry 2000 2 296-297

Novelty

As none of D1-D3 describe liquids wherein the molar mixing ratio between the Lewis acid(s) and the triflate or bis(trifluoromethylsulfonyl)imide salt(s) is greater than 1:1, the present claims 1-12 are new over these documents.

Claims 1-12 fulfil the requirements of Article 33(2) PCT.

Inventive step

The technical problem underlying claims 1-12 appears to be the provision of a more effective ionic liquid-Lewis acid mixture. This has allegedly been achieved by the addition of over 50 mol% of the Lewis acid. D1 states (p. 5, l. 21 to p. 6, l. 8) "in Friedel-Crafts acylation reactions the "catalyst" is usually a stoichiometric reagent. However, catalyst loading can now be lower; as low as 1 mol % metal bis-triflimide can give rise to quantitative yields in Friedel-Crafts acylation reactions. The compounds of the present invention will catalyse chemical reactions in concentrations within the range 0.0000001 to 1000 mol %, preferably within the range of 0.1 to 20 mol % and more preferably within the range of 0.5 to 5 mol %. This reduces catalyst waste". Thus D1 already suggests the use of stoichiometric or superstoichiometric concentrations of Lewis acid, but its preferred embodiments employ smaller concentrations, apparently in the interests of reducing waste. D1 also suggests a way of minimising catalyst waste, see e.g. example 6, where it is stated "The ionic liquid/zinc chloride catalyst system could be used in further reactions, with similar activity". Thus the skilled person would, on reading D1, know that it was possible to use higher concentrations of catalyst in an ionic liquid, and that this system could be recycled after use. Thus claims 1-12 are obvious over D1.

Claims 1-12 do not fulfil the requirements of Article 33(3) PCT.

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Industrial applicability

Claims 1-12 fulfil the requirements of Article 33(4) PCT.

VIII. Certain observations

There is a contradiction between claim 1 and its dependent claim, claim 3. In claim 1 the molar mixing ratio between the Lewis acid(s) and the triflate or bis(trifluoromethylsulfonyl)imide salt(s) must be greater than 1:1. In claim 3 the total molar contents of the Lewis acid in the mixture is from about 50-85%. Thus claim 3 covers mixtures wherein the ratio is 1:1, rather than >1:1. This contradiction gives rise to uncertainty concerning the essential technical features of the invention, leading to a lack of clarity of the claims (Article 6 PCT).

What is claimed is:

1. An ionic liquid comprising a mixture of one or more triflate or bis(trifluoromethylsulfonyl)imide salt(s) with one or more Lewis acid(s) wherein the molar mixing ratio between one or more Lewis acid(s) and one or more triflate or bis(trifluoromethylsulfonyl)imide salt(s) is greater than 1:1.
2. The ionic liquid of claim 1 wherein the mixing ratio between one or more Lewis acid(s) and one or more triflate or bis(trifluoromethylsulfonyl)imide salt(s) is greater than 2:1.
3. The ionic liquid of claim 1 or 2 in which the total of the molar contents of the Lewis acid(s) in the mixture is from about 50–85%.
4. The ionic liquid of any preceding claim in which the total of the molar contents of the Lewis acid(s) in the mixture is from about 67–80%.
5. The ionic liquid of any one of any preceding claim, wherein the triflate or bis(trifluoromethylsulfonyl)imide salt that is used is an
 - (1) ammonium,
 - (2) phosphonium,
 - (3) imidazolium, or
 - (4) pyridinium salt.
6. The ionic liquid of claim 5 wherein the cation of the triflate or bis(trifluoromethylsulfonyl)imide salt is (1) a quaternary ammonium cation having the general formula $[NR^1R^2R^3R]^+$; (2) a phosphonium cation having the general formula $[PR^1R^2R^3R]^+$; (3) an imidazolium cation having the general formula of Formula I:



where the imidazole ring of Formula I can be substituted with one or more groups selected from the C₁–C₈ alkyl, C₆–C₁₂-aryl, or C₅–C₁₂-aryl-C₁–C₆ alkyl groups; (4) pyridinium cations of the general formula of Formula II



where the pyridine ring of Formula II can be substituted with one or more groups comprising the C₁-C₈ alkyl, or C₆-C₁₂-aryl, or C₅-C₁₂-aryl-C₁-C₆ alkyl groups;

and the substituents R, R', R¹, R², R³ are selected independently of each other from the group comprising hydrogen; linear or branched, saturated or unsaturated, aliphatic or alicyclic alkyl groups having 1 to 20 carbon atoms; and aryl, aryl-C₁-C₆ alkyl groups having 6 to 12 carbon atoms in the aryl moiety, which may optionally be substituted with at least one C₁-C₆ alkyl group.

7. The ionic liquid of any preceding claim, wherein the Lewis acid is AlCl₃, AlBr₃, SnCl₂, FeCl₃, or ZnCl₂.
8. The ionic liquid of claim 7, wherein the Lewis acid is AlCl₃.
9. The ionic liquid of claim 7, wherein the Lewis acid is FeCl₃.
10. The process for preparing the ionic liquid of any preceding claim comprising proportionally adding the Lewis acid(s) to the triflate or bis(trifluoromethylsulfonyl)imide salt(s) while stirring at temperatures from 0 to 300°C, preferably from 20 to 180°C, more preferably from 50 to 150°C, to yield the ionic liquid as a liquid-liquid multiple-phase system.
11. The use of the ionic liquid of any preceding claim as the catalyst or catalytically active reaction medium, wherein the reaction is an Lewis acid-catalyzed reaction.
12. The use of claim 11 in which the Lewis acid-catalyzed reaction comprises Friedel-Crafts alkylation reactions, Friedel-Crafts acylation reactions, alkylation reactions, carbonylization reactions, isomerization reactions, and oligomerization reactions.